COMP9444 Neural Networks and Deep Learning
Session 2, 2018

Exercises 7: Hopfield Networks

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1. Can the vector [1, 0, –1, 0, 1] be stored in a 5-neuron discrete Hopfield network? If so, what would be the weight matrix for a Hopfield network with just that vector stored in it? If not, why not?

2.
   a. Compute the weight matrix for a Hopfield network with the two memory vectors [1, –1, 1, –1, 1, 1] and [1, 1, 1, –1, –1, –1] stored in it.
   b. Confirm that both these vectors are stable states of this network.

3. Consider the following weight matrix W:

$$\begin{bmatrix} 0.0 & -0.2 & 0.2 & -0.2 & -0.2 \\ -0.2 & 0.0 & -0.2 & 0.2 & 0.2 \\ 0.2 & -0.2 & 0.0 & -0.2 & -0.2 \\ -0.2 & 0.2 & -0.2 & 0.0 & 0.2 \\ -0.2 & 0.2 & -0.2 & 0.2 & 0.0 \end{bmatrix}$$

   a. Starting in the state [1, 1, 1, 1, –1], compute the state flow to the stable state using asynchronous updates.
   b. Starting in the (same) state [1, 1, 1, 1, –1], compute the next state using synchronous updates.

Make sure you try answering the Exercises yourself, before checking the Sample Solutions